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9 APRIL 1980 (FOUO 4/80) 1 OF 1

JPRS L/9026

9 April 1980

Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

(FOUO 4/80)

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WORLDWIDE REPORT

NUCLEAR DEVELOPMENT AND PROLIFERATION

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JAPAN

'YOMIURI' EDITORIAL COMMENTS ON RESULTS OF INFCE MEETING

OW030825 Tokyo THE DAILY YOMIURI in English 29 Feb 80 p 2 OW

[Editorial: "A-Power for War or Peace"]

[Text] The International Nuclear Fuel Cycle Evaluation (INFCE) meeting which closed in Vienna on Wednesday sought ways to make nuclear nonproliferation compatible with the peaceful uses of atomic energy. But the meeting mainly focused on the technical problem of setting up an international inspection system to halt the proliferation of nuclear weapons and to survey the peaceful uses of atomic energy. Some progress was achieved, but many problems remained unsolved.

The INFCE was established in line with the nuclear nonproliferation policy adopted by the U.S. in 1977. The policy mainly aims to prevent plutonium produced in the process of nuclear electric power generation from being used in nuclear weapons. The basic flaw in this U.S. policy is that it approached the problem from the technical aspect, whereas the matter actually is a political decision. In fact, the INFCE communique issued at the end of its plenary session stated that nuclear nonproliferation is a political problem and not a technical one.

A Restrictive Blow

U.S. policy overlooks the fact that a country intending to use atomic energy for electric power generation will go ahead and set up such facilities for its own use. By imposing restrictions on atomic power generation, the U.S. is dealing a blow to other Western nations seeking to use atomic energy for power generation.

The INFCE report stressed the importance of atomic power generation and said it favored the development of fast breeder reactors, the enrichment of uranium and the reprocessing of nuclear fuels. While this means that the INFCE has accepted the positions of Japan and the West Europeans, we should not rejoice too soon.

The decisions of the INFCE are not binding on its member nations. It is inconceivable that the U.S. will revise its nuclear nonproliferation policy in the near future. Under the Japan-U.S. agreement on the use of atomic energy, the U.S. maintains the right to give prior approval or disapproval on the reprocessing of uranium by Japan. It's highly unlikely the U.S. will give up or relax this right. This means Japan is obliged to negotiate with the U.S. whenever she wishes to reprocess nuclear fuels or construct nuclear fuel reprocessing plants.

Discriminatory Policy

The INFCE report states that it will approve the right of advanced countries to enrich uranium and reprocess nuclear fuels, but that it will deny the same rights to the developing countries until it becomes necessary. Naturally, the developing countries will oppose this discriminatory policy. They are expected to strike back when a meeting is held in August to review the nuclear nonproliferation treaty.

If this problem becomes a political football between the developing and advanced nations, then the entire nuclear nonproliferation system could collapse. It is meaningful that the INFCE meeting came up with a number of alternative international systems to curb nuclear proliferation.

Japan's uranium enrichment and nuclear fuel reprocessing projects should be considered within an international framework. It is necessary to create an international environment to prevent the development of atomic energy techniques from being converted into the production of nuclear weapons.

CSO: 5100

GABON

BRIEFS

GOOD URANIUM PRODUCTION PROSPECTS--The administrative council of the Franceville Uranium Mining Company (COMUF)meet on 6 February in Libreville under the chairmanship of Maurice Delauney, former French ambassador to Gabon. In 1979 the COMUF succeeded in increasing slightly the projected production. Good operating conditions at the Mounana factory made it possible to produce 1,100 tons of concentrated uranium as against 1,022 tons in 1978. Sales amounted to 1,252 tons, comparet to 1,050 tons in 1978. The COMUF development plans include various studies, specifically on the exploitation of the Boyindzi deposits, the construction of a new sulfuric acid laboratory with a daily production of 60 tons and on the construction of a new processing plant of a capacity of 400,000 to 500,000 tons of ore per year, compared to the capacity of the present factory of 270,000-280,000 tons. It would thus be possible in the future to produce annually 1,500 tons of concentrated uranium. [Excerpts] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 29 Feb 80 p 517]

CSO: 5100

UN COUNCIL MOVES TO PROTECT RESOURCES, URANIUM

Paris AFRIQUE-ASIE in French 24 Dec 79-6 Jan 80 p 35

[Article by Fode Amadou: "The Uranium-Rush"]

> [Text] The United Nations wished to protect the greatest resource of Namibia. The multinationals resort to shameless pillage there."

On 24 September 1974 the General Assembly of the United Nations adopted a resolution forbidding exploitation of the resources of Namibia. The text read: "No individual or entity, whether or not organized as a company, is permitted to seek, prospect, take, extract, exploit, treat, refine, utilize, sell, export or distribute any natural resource whatsoever [belonging to this country], whether its origin is animal or mineral, situated within the territorial limits of Namibia without the consent and authorization of the United Nations Council for Namibia." The resolution additionally provided for sanctions against violators, namely confiscation by the United Nations of vehicles and loads, actions at law for reparations on behalf of the future government of independent Namibia....

All that has remained a dead letter. To be more exact, out of fear that Namibia might become independent the multinationals have been helping themselves in double mouthfuls and are resorting to a veritable pillage of the chief underground resource of Namibia, where are to be found the largest quantities of uranium anywhere in the world. Besides, at the moment when the underground fighters of SWAPO [SWAPO Democrats] commenced their first operations, the aforementioned corporations went to the assault of the Rossing Mine, whose annual production is on the order of 5,000 tons of uranate, or yellow cake.

And for the past 2 years, by way of "bending" the UN recommendations, a whole clandestine commercial circuit has been set up, in which France's role is pivotal. This is what has just been revealed in detail, with supporting documents, in an investigation by the French daily LIBERATION, whose information has never been contradicted--and for good reason. This information has even been broadly confirmed by recent events.

Several multinations, the largest of which is Rio Tinto Zinc (a British multinational owning interests in copper, gold, zinc, iron, and aluminum, and owns around 47 percent of the capital stock in the company working the Rossing Mine) are implicated in the affair. A cartel of sorts has put itself together around Rio Tinto Zinc, banding together three countries, Canada, France, and of course South Africa.

The French multinationals are right in the game with Minatone (10 percent of the stock) which is owned (50-50) by Pechiney Ugine Kuhlmann and Compagnie Francaise des Petroles. South Africa for its part is represented by two groups: General Mining and Finance Company Ltd. (6.2 percent) Rio Algon (Canadian subsidiary of Rio Tinto Zinc) hold 10 percent of the stock and "divers participants" hold 11.5 percent. Two thousand Blacks work in the Rossing Mine and extract 150,000 tons of rock from it each day.

Since January 1978 uranate (in violation of UN resolutions, but worse still, in contempt of the most elementary rules of security) is shipped to France from the Namibian port of Windhoek. And so, twice a week, planes supplied by the French company UTA and South African Airways carry as cargo 33 tons of yellow cake. This radio-active cargo is unloaded partly at Marseille-Marignane, partly at Roissy and Orly. From Marseille the yellow cake is freighted to the Malvesi uranium conversion plant near Narbonne, belonging to COMURHEX [expansion unknown], a company in which the French Government is a shareholder through the intermediary of COGEMA [expansion unknown], and where, out of sight, out of mind, the mineral loses its Namibian nationality. At Roissy and Orly it is picked up by trucks and about half the yellow cake is hauled to British nuclear centers. The "French Connection" by devious routes also supplies the West German nuclear industry....

Great Britain has already had a quarrel with SWAPO over this uranium business. The FRG, for its part, wants to cover up the scandal. As for France, which serves as a sort of roundhouse revolving platform for this traffic, feels no embarrassment of scruples: it considers the UN resolution purely and simply as null and void, and something which never happened. The proof: in a letter dated 2 April, addressed to the General Manager of UTA, Mr Guy Georgy, in charge of the African and Malagasy Affairs Desk at the Quai-d'Orsay, stated the following: "France, for its part, considering illegal the presence of South Africa in Namibia, has only undertaken the commitment to limit its economic activities in this territory as long as the country is not independent. But neither France nor most of the other countries recognize the slightest validity in Decree No 1," (Decree No 1 of the text adopted in 1974 by the General Assembly of the United Nations). No comment...

The Gang of Five

By a curious coincidence, following the investigation by the newspaper LIBERATION, UTA Airline announced that as of 1 January 1980 it was withdrawing from the fabulous contract for air-freighting the Namibian uranium concentrate. The reason was that the group of industries working the Rossing Mine had gotten a "better deal." The pillage would continue as before, but from now on the uranium would be shipped by water...

At least, this scandal, which is beginning to be revealed could make waves and draw a reaction from Western public opinion which could actually play a decisive role. This is what is emphasized in a recent statement by SWAPO, recognized everywhere as spokesman for the Namibian people, which accentuates the duplicity of the governments which are members of the "Western contact group," theoretically constituted to help by negotiation in Namibia's gaining independence...

"While France, Great Britain and the German Federal Republic are proceeding with the pillage of Namibian uranium, they have for the past 2 years carried on discussions with South Africa and SWAPO about Namibia's future within the framework of the so-called "Western contact group" (USA, Canada, FRG, France and the United Kingdom). This demonstrates once again that these five Western countries are the accomplices of the Pretoria regime and aim to establish in Namibia a government acquiescent to their interests," so states the communique of the South-West African Peoples Organization.

SWAPO demands the cessation of the pillage and appeals to public opinion in France, Britain and West Germany to exert pressure on their governments and asks support in this action by the trade unions involved.

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CSO: 5100

USSR

UDC: 621.165.621.311.25:621.039

LOVIISA-1 NUCLEAR POWER STATION

Moscow TEPLOENERGETIKA in Russian No 2, Feb 80 pp 36-40

[Article by E. Miyettinen, A. Laukia and A. Vuorenmaa, Imatran Voima Company, Helsinki: "Turbine Unit Setup and Operation at the Loviisa-1 Nuclear Power Station"]

[Text] The Soviet-built VVER-440 reactor and type K-220-44 steam turbines are in operation at Loviisa-1, Finland's first nuclear power station. Of great importance for startup and adjustment operations was interconnection of process systems supplied by the Soviet Union and electrical systems and monitoring-test instruments supplied by Finland and the FRG.

Figure 1 contains a nuclear power station operating graph -- the average monthly load factor with a gross generating capacity of 465 megawatts. During a 22-month period of commercial operation the Loviisa-1 Nuclear Power Station has been among the world leaders in operating efficiency.

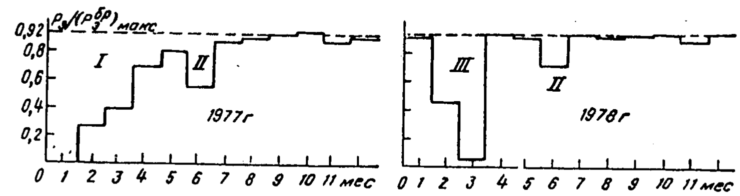

Figure 1. Average Monthly Load Factor for the Months of 1977 and 1978

I -- startup and adjustment period; II -- scheduled shutdown; III -- fuel recharging (6 weeks): $(P_{бр})_{makc}$=465 megawatts

In this article we shall examine turbine unit startup and adjustment procedures and operation and analyze the condition of equipment during the annual inspection performed at the time of the second fuel recharging.

Turbine Unit Loading Tests

The principal stages up to the end of the warranty period are listed below.

Beginning of tests at 5% power	2 Feb 1977
Beginning of tests at 15% power	5 Feb 1977
Synchronization of TG-1 in power line	8 Feb 1977
Beginning of tests at 30% power	9 Feb 1977
Synchronization of TG-2 in power line	19 Feb 1977
Beginning of tests at 50% power	23 Feb 1977
Beginning of tests at 75% power	11 March 1977
Beginning of tests at 92% power	16 April 1977
Beginning of 14-day running test	23 April 1977
Beginning of station operation warranty	9 May 1977
Tests at 100%, first stage	18-20 Jan 1978
Tests at 100%, second stage	8-17 Nov 1978
End of station operation warranty period, after 15,000 hours in operation	30 April 1979

Load tests can basically be divided into control and monitoring system tests, dynamic and physical tests. Correct adjustment and functional settings of control devices, interlockings and safeguards were definitively determined during the first tests. During dynamic tests the station's capability to cope with various interference and disturbances both at the nuclear power station proper and in the power line was tested. Physical tests apply to the primary circuit.

Table 1 lists the power levels during the most important dynamic tests of the turbine unit startup and adjustment period. Tests 1-6 applied directly to the turbine unit, while tests 7 and 8 are connected with safeguards and power restrictions proceeding from tests of the YaPPU [expansion unknown] systems. The principal tests were repeated at higher power levels. The volume of testing was influenced primarily by the following factors. The Finnish Radiation Safety Institute, which is responsible for monitoring nuclear power station safety, assumed performance of a certain volume of testing to ensure nuclear power station safety. As a consequence of alternative operating modes as well as the diversified functions of automatic monitoring and control, it was necessary to conduct tests with various initial states. The volume of testing was again increased, since at maximum power output at a level of 92 percent, at the demand of the Radiation Safety Institute, the overwhelming majority of tests were performed both at the given power level and later were performed again at the rated level. With the repeated tests new data were obtained on physical changes in the reactor taking place as fuel depletion occurred, as well as on their influence on the dynamic characteristics of the nuclear power station.

Table 1. Basic Dynamic Tests When Putting Turbine Units Into Operation

No	Test	Power Level, % $P_{\text{бр}}$ =235 Megawatts				
		25-30	50	75	92	100
1	Turbine no-load running	TG-1;0	-	100;TG-2	TG-1+TG-2	-
2	Turbine operating for local requirements	TG-1;0	-	100;TG-2	TG-1+TG-2	TG-1+TG-2
3	Feedwater pump switchoff test	-	-	+	+	+
4	Feedwater pump switch-over test	-	-	+	-	-
5	PVD [expansion unknown] unit bypass	-	-	TG-1	-	-
6	Cooling-water pump switch-off test	-	-	TG-1;TG-2	-	-
7	Type 1 reactor core test	+	+	-	+	+
8	Switching off one, two and three primary circulating pumps	+	+	+	+	+

The deficiencies noted during these tests did not apply so much to normal operation as to infrequent transient states during station operation. After testing it was necessary to make some changes, involving increasing or changing various time constants, revision of the rate of transient conditions, adjustment of various additional controls and safeguards, as well as detailing and refinement of operating instructions.

Tuning and Adjustment of the Main Control Systems

The Loviisa-1 control system was designed in collaboration by Soviet, Finnish and German specialists. Operation of these systems was tested on a computer model specially constructed for this purpose. A portion of the system equipment was tested and preadjusted while hooked up to the computer model prior to final installation. At this stage of the testing certain changes were made in the control system, and defects in the wiring and equipment were corrected.

Some problems during startup and adjustment involved pressure fluctuations in the turbine control hydraulic system, which caused short circuits across quick-response pushbutton switches. In addition, turbine electric governor shaft rpm proved to be too low, which complicated measurement of rpm and monitoring rpm during startup. All these problems were resolved with normal startup and adjustment measures, such as new limit adjustments, delay increase, etc.

Numerous tests and adjustments under various operating and emergency conditions were performed for the turbine control systems. Figures 2-4 show changes in turbine rpm and power during tests, as well as rates of change (the figures do not show power changes during daily and weekly adjustment procedures as well as power changes during warranty tests). To test safeguard systems seven short circuits were performed on TG-1 during no-load running, and eight on TG-2.

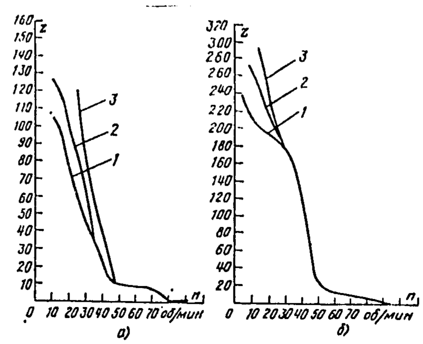

Figure 2. Number (z) and Value of rpm Changes During Testing and Adjusting rpm Governor

a -- turbine unit 1; b -- turbine unit 2; 1 -- $\Delta t < 5$ s; 2 -- $\Delta t < 10$ s; 3 -- $\Delta t < 50$ s.

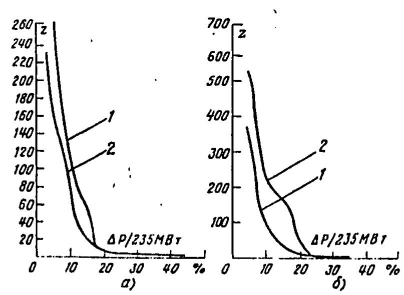

Figure 3. Number of Power Change Tests on Turbine Unit 1 (a) and 2 (b).

1 -- $\Delta t < 10$ s; 2 -- $\Delta t < 1$ min.

The fact that during this time turbine hydraulic system changes were designed, implemented and tested, changes which made it possible to shift from an electrohydraulic to a hydraulic governor and vice versa while leaving turbine power or rpm practically unchanged proved to be very valuable for startup and adjustment testing of control systems. The economic effect of this is considerable, since it makes it possible in an

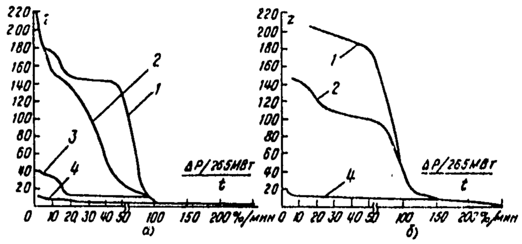

Figure 4. Number of Tests on Various Power Change in Relation to Rate of This Change for Turbine Unit 1 (a) and 2 (b).

1 -- $\Delta P \geq 8\%$; 2 -- $\Delta P \geq 10\%$; 3 -- $\Delta P \geq 17\%$; 4 -- $\Delta P \geq 35\%$.

electrical control system to make changes and perform repair procedures when turbogenerators are operating at full power. This modification, made by Soviet specialists, was able to be used during startup and adjustment.

The number of transient conditions on TG-2 was considerably greater than on TG-1. This was determined chiefly by the fact that when performing pressure adjustments on TG-2 pressure disturbances were caused by turbine or reactor bypass valves. During adjustment of the TG-1 pressure control circuit pressure disturbances were caused by TG-2. The turbine control systems at Loviis-1 are quick-response. Tables 2-4 contain the principal characteristics of the turbine control systems.

Table 2. Dynamic Characteristics of Turbine Control Systems

Characteristics	Power Adjustment	rpm Adjustment
Transient characteristic:		
rise time, seconds	5-6	~4
excess, %	<20	12-14
attenuation factor	>0.95	0.6-0.7
stabilization time, seconds	<20	0.8-1
Frequency characteristic (frequency < 0.016 Hz):		
amplification	~1	>0.9
degree drop	<15	<15

Table 3. Power Restrictions Caused by Pump Switchon Conditions

Pump	Number	Allowable power, megawatts
Primary circulating pumps	0-2	–
	3	248
	4	327
	5	405
	6	483
Feedwater pump	1	130
	2	260
	3	390
	4	520
Seawater pump	1	130
	2	260

Table 4. Power Restriction Change Rates

Pump	Delay, seconds	Rate of Change, Megawatts per second
Primary circulating pump	-	4.5
Feedwater pump	1.6	4.5
Seawater pump	10	1.2

Unscheduled Shutdowns During Startup and Adjustment Period

Table 5 lists the causes of short circuits during the startup and adjustment period. Causes include defects in mechanical and electrical equipment and in monitoring and testing instruments. During analysis of secondary circuit operation, unscheduled short circuits were most frequently caused by an excessively high level in the steam generator (three on TG-1, three on TG-2, and one short circuit of both turbines). They were also caused by incomplete adjustment of the steam generator level control mechanisms, incorrect control mechanism actuation at that moment, or excessive feeding of water by the pumps on pump shutdown and restart. Feedwater pump shutdown resulted in intake screen fouling. In addition, short circuits were caused by generator switchoffs, caused by defects in the cooling systems and activation system.

Table 5. Causes of Unscheduled Turbine Shutdowns During the Startup Period

Causes of Shutdowns	TG-1	TG-2
Reactor or auxiliary reactor system	5	4
Turbine or intermediate heating	2	-
Steam-water circulation system	6	5
Generator or auxiliary generator system	2	1
Other	3	5

Note: The table does not list shutdowns caused by hydraulic pressure fluctuations during adjustment of turbine hydraulic control systems on no-load running and at low power.

Table 6 contains a list of unscheduled turbine shutdowns at various output levels during the startup and adjustment period. Adding together the total number of turbine short circuits at various reactor output levels indicates that the number of short circuits decreases in the process of performance of startup and adjustment procedures, adjustment of the power generating process and related systems and removal of corrosion and other contaminants from the operating environment. On the whole the number of short circuits during the period of building up power can be considered small.

Table 6. Unscheduled Turbine Shutdowns at Various Output Levels During Startup Period

Reactor Thermal Output, %	Electrical Output, %									
	Turbo-Set 1					Turbo-Set 2				
	<20	20-40	40-60	60-80	80-100	< 20	20-40	40-60	60-80	80-100
20	-	-	-	-	-	-	-	-	-	-
20-40	3	1	7	-	-	-	-	3	-	-
40-60	-	-	1	-	3	3	-	1	-	3
60-80	-	-	1	1	-	-	-	-	2	2
80-100	-	-	-	-	1	-	-	-	-	1

From the standpoint of dynamic processes, difficulties were connected with parallel-operating deaerators. In transient conditions, a consequence of which was nonuniform deaerator loading, strong fluctuations were noted in the feedwater tanks and adjacent lines, with pressures and levels deviating from the rated value. This problem was solved by adding an auxiliary control mechanism to feed additional steam into the deaerator with less pressure and separation of the additional feedlines leading into the feedwater tanks in such a manner that they could operate independently.

Equipment Operational Readiness Tests and Economy Measurements

Equipment operational readiness tests were performed during the station's two-year warranty period. Station output was restricted to 92 percent, with the exception of two periods of full output (a total of 13 days), during which tests were performed at 100% power as indicated in Table 1, as well as economy measurements to determine maximum electric power generated and net thermal output.

Dynamic characteristics and control characteristics were determined in the following conditions: short-duration adjustment; daily and weekly adjustments; shift of one turbogenerator to internal requirements mode, maintaining power output on the second turbogenerator; shift of station to internal requirements mode; participation in maintaining power line frequency; short circuit of 0.2 second duration; frequency fluctuations within the range 47.0-51.5 Hz during reactor operation at 70% output and turbogenerators operating in internal requirements mode.

During the first two tests maximum output changes were as follows: $\Delta P = \pm 30\% \, P_{nom}$ with specified $\Delta P/\Delta t = 1.85\%/\text{min}$; $\Delta P = \pm 20\% \, P_{nom}$ with specified $\Delta P/\Delta t = 8\%/\text{min}$; stepped output change $\Delta P = -20\% \, P_{nom}$.

During these tests the station was partially, that is, not during the entire time, connected to the power line control mechanism and thus was operating in combined frequency control mode.

In the remaining tests the efficiency of the station control system was tested with large changes in output, as well as in specific voltage and frequency ranges.

The following dynamic characteristics were obtained as a result of the tests.

1. The nuclear power station can operate briefly in control mode in a 70-92% output range and participate in combined frequency control within limits of ±5% rated output. Stepped change in nominal output up to 20% without exceeding allowable process parameters is also permitted.

2. The nuclear power station can operate in daily adjustment mode in a range 60-92% with a rate of output change of 1.85% of rated output per minute and in a range 70-92% with a rate of change of 8% rated output per minute.

3. When one turbogenerator is operating for internal requirements, the other unit continues operating under load without interruption.

4. The electrohydraulic rpm governor withdraws the nuclear power station to internal requirements without switching over to standby internal requirements.

5. The generator and startup voltage regulator systems permit a short circuit of 0.2 second duration in the high voltage lines without switching off equipment. Stability is reached within 2 seconds after the disturbance ends.

6. The nuclear power station can operate at a frequency deviating from rated for approximately 5 minutes in the range 47-51.5 Hz and continuously in the range 49.0-59.5 Hz.

These output changes and rates of change are determined by the control system. Nevertheless, in view of some unresolved questions pertaining to fuel, the deviations employed at the Loviisa-1 Nuclear Power Station are significantly smaller than those listed above.

Economy measurements were performed at the beginning and end of the warranty period. The following preliminary measures were taken for this purpose: determination of an experimental curve of correction for condenser pressure influence on turbine output; calibration, with computer assistance, of operating measurements utilized for monitoring rated parameters; various mass and energy balance investigations.

Both principal periods of warranty measurements included 15 measurements at 80, 90 and 100% output levels. Gross and net electric power outputs (Figure 5) and net specific thermal output (Figure 6) with correction for cooling-water temperature equal to ±5°C were determined on the basis of these measurements.

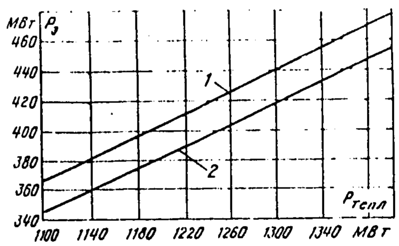

Figure 5. Gross (1) and Net (2) Electric Power Output in Relation to Reactor Thermal Output

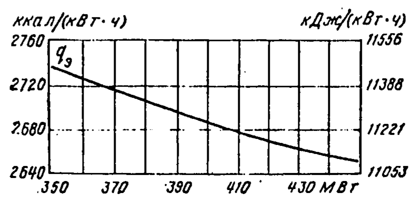

Figure 6. Net Specific Heat Output

Operating Experience

Table 7 lists the causes and number of unscheduled turbine shutdowns during operation. Twice they were caused by a rise in level in the condensate collector of the superheater separator, twice by faults in the thyristor excitation cooling system, and four times by a drop in level in the upper oil tank due to oil pump shutdown during testing of electrical systems, during disturbance, as a consequence of difficulties in oil tank operation, and by other causes. Table 8 indicates unscheduled turbine shutdowns at various output levels during commercial operation.

Table 7. Unscheduled Turbine Shutdowns During Commercial Operation Up to 1 May 1979

Causes of Unscheduled Shutdowns	TG-1	TG-2
Reactor or reactor auxiliary system	-	-
Turbine or intermediate heater	3	-
Steam-water circulation system	-	-
Generator or generator auxiliary system	1	1
Other	7	4

Table 8. Unscheduled Turbine Shutdowns at Various Power Output Levels During Commercial Operation

Reactor Thermal Output, %	Electric Power Output, %									
	TG-1					TG-2				
	< 20	20-40	40-60	60-80	80-100	< 20	20-40	40-60	60-80	80-100
< 20	-	-	-	-	-	-	-	-	-	-
20-40	1	-	-	-	-	-	-	-	-	-
40-60	-	1	-	-	-	-	-	1	-	-
60-80	-	-	-	1	-	-	-	-	-	-
80-100	-	-	-	-	8	-	-	-	-	4*

* Includes one total load loss without shutdown

The number of unscheduled turbine shutdowns was considerably fewer than the number of scheduled shutdowns. Cessation of generation of electric power during unscheduled turbine shutdowns totaled approximately 5000 megawatt-hours during commercial operation (over a period of 22 months). This means that turbine restart took place quickly following shutdown.

The following stepped power output decreases on both turbines were observed during commercial operation: 15 times as a consequence of primary circulation pump shutdown, once as a result of shutdown of the main feedwater pump without the standby pump cutting in, and once as a result of a disturbance which shut down all primary feedwater pumps. There was one turbogenerator main seawater pump shutdown. The main condensate pumps shut down repeatedly; this caused a main condensate pump shutdown with power decrease once on TG-1 and three times on TG-2. Shutdowns and startups of the main condensate pumps were observed in all four instances, which does not automatically cause a stepped power decrease.

Disturbances in the main power system caused a 65 megawatt stepped power increase in the turbine on one occasion and on one occasion three successive rapid power fluctuations; power on the turbines fluctuated from +40 megawatts to -80 megawatts. Neither turbogenerator was disconnected from the power line. As a result of disturbances in startup, on two occasions TG-2 was shifted to no-load rpm, but without shutdown. A relatively small number of causes led to a controlled power reduction or shutdown, and in these cases repair procedures were performed quickly. Condenser tube failure during operation was observed on nine occasions. On one occasion the live-steam safety valve opened by mistake and remained in the open position. There were many instances of leakage in the boxes and on flanges. On two occasions leakages on flanges were the cause of turbine shutdown. In addition there were disturbances in the generator cooling system; on one occasion the generator moisture level rose because of water leakage from the cooler, and a large hydrogen leakage was observed on one occasion.

The turbines proper operated reliably, and no excessive vibrations or exceeding of allowable values were observed. Bearing temperatures remained within specified values, with the exception of one insignificant temperature rise.

Leakage was observed in only one instance in the separator-superheaters and in the heaters. It was noted that, in addition to difficulties connected with materials, many turbo-set pumps show an elevated vibration level.

There is a substantial quantity of stop-valve fittings on the nuclear power station turbine installation because of the two turbines operating in parallel. The fittings performed better than projected and did not constitute a significant cause of disturbance to equipment operation. Fitting tightness, however, was insufficient.

The following was noted during inspections conducted during commercial operation. In the seawater system corrosion damage was observed in the lines, turbine oil coolers, feedwater pump motor coolers, generator gas condensers, and in the seawater pumps. All lines less than 100 mm in diameter and a portion of the 200-300 mm diameter lines had to be replaced with plastic pipe or protected by a rubber coating. It was noted that the blade pitch angle control mechanisms readily fail. The housing and rotating components of the circulating water pumps of the turbine condensate system contained corrosion damage as a consequence of employment of unsuitable material. Substantial cavitation was observed on the main condensate removal pumps during initial operation, but after increasing lift and changing the geometry and material of the intake cones and impellers and boosting flow, the main condensate removal pumps have been operating normally.

During the annual inspection following 22 months of commercial operation, the high-pressure cylinder and one of the low-pressure cylinders on one turbine were opened up. Inspection revealed that the turbine was in good condition. Small traces of erosion were discovered on the high-pressure cylinder packing seat flange, on some shaft sealing units and on the guide vane bolting. One of the bolts had weakened on the high-pressure cylinder first stage blade retainer. Lengthwise cracks were discovered on two check valve stems. The previously-discovered comparatively large porous surface zone was repaired during the inspection. The high-pressure cylinder and low-pressure cylinder blades looked almost like new. Nor were there any problems with deviations from tolerances and alignment. In view of the inspection results, there was no need to tear down the second turbine. A generator inspection revealed that the winding wedges had weakened; they were replaced with new ones.

In the most recent annual inspection the condenser tubes were checked by the eddy current method. The test revealed 0.4-0.6 mm corrosion damage on 8% of the tubes in the upper part of the condenser. There was considerably less damage in the lower part of the condenser. Corrosion damage at a distance of 5-10 cm from the end of the tube was observed in the lower tubes on the inlet side. If the corrosion process is not corrected in the next few years, it will be necessary to plug a considerable number of tubes.

On the basis of data from numerous tests, the system was adjusted both for normal operation and for emergency conditions. Proof of this is the station's good efficiency during commercial operation.

Demands pertaining to load monitoring and resistance to disturbances, voltage and frequency changes are quite satisfactorily met by the control system.

Net measured thermal output at the station was 2,682.4 kcal/(kilowatt hour), and maximum net electric power output was 445.7 megawatts. The guaranteed figures were 2,858 kcal/(kilowatt hour) and 420 megawatts respectively. The results of the tests performed at the beginning and end of the warranty period differed insignificantly, which indicates the good condition of the equipment during the entire warranty period. This is also confirmed by inspection of one of the turbines during the second fuel recharging.

The number of unscheduled shutdowns, stepped power changes and disturbances caused by power reduction was small, and their causes were rapidly corrected with subsequent restoration of the normal power output level.

Operating experience indicated that it is advisable to have a separate independent deaerator for each turbine installation.

Corrosion examination indicates the requirement of more suitable materials for equipment in contact with seawater.

Of the process equipment, the pumps required more servicing and maintenance. The remainder of the primary equipment and valves, however, worked well.

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FEDERAL REPUBLIC OF GERMANY

STORAGE PROBLEMS WITH LOW-LEVEL RADIOACTIVE WASTE MATERIALS

Hamburg CAPITAL in German Feb 80 pp 38-40

[Article: "Atomic Garbage in German Cities"]

[Text] In the contest over the storage of highly active nuclear reactor waste, a huge quantity of other atomic residues goes almost unnoticed. This radiating rubbish is uniformly distributed over the nation--very close to home.

On the over 70-year-old mining company building of the Salzberg Works in Asse in the Wolfenbuettel district of Lower Saxony, an ornate sign in German script greets the visitor with "Good Luck [going down]," whereas it should read "Good Luck [going up]" since the conveyor cage has not been brought to the surface in over 15 years. Instead, it has been moved further into the mine, a jumbled load of radioactive refuse consisting of over 124,000 containers.

The shaft installation was purposely evacuated to serve as a repository for atomic waste to provide proof that radioactive waste can be stored safely underground in the salt. This is the basis for putting into operation the planned Gorleben nuclear disposal center which is also located in Lower Saxony. When the wave of rebellion over the gigantic Gorleben project threatened to undermine Ernest Albrecht's (CDU) weak mandate to govern in Hannover, the fate of the Asse experimental storage facility was also decided. It was closed two years ago.

Since then, the discussion has centered around the question of whether the highly radioactive waste, with its millinieum-long deadly radiation, should be reprocessed. Power plant builders, electric companies, politicians and citizens groups are the contestants. However, the low- and medium-level radioactive waste which previously disappeared into the Asse without citizen protests has passed into oblivion. This waste makes up 99 percent of the volume of nuclear waste but contains only 1 percent of the radioactivity. A huge volume--at least 20,000 drums per year, each containing 200 liters--has been stacking up in the storage depots of the Federal

Laender and at the nuclear power plants since the closing of Asse. The medium-level residue generated primarily by nuclear research centers can get by with a concrete radiation shield and requires no cooling. This is not true, however, for reprocessed corrosive, high-level radioactive residues which, even after being melted into glass blocks, still produce a temperature of 250 degrees C. The low-level trash--such as the boots of nuclear power plant workers, residue from luminous dials of the watch industry or lead shields of radiologists--can, because of its low radiation, be stored safely in steel containers.

What is lacking--after the unexpected temporary closing of Asse--is adequate storage space. Investments running into the millions are required to store 200,000 drums of radioactive waste until the end of the present decade in buildings at the city limits of Berlin, Hamburg, Munich, Karlsruhe, Kassel and Juelich. For, previously, hardly any of those involved thought seriously about the necessity of reopening Asse due to the tedious authorization process [for Gorleben]. Prof Dr Horst Boehm, member of the board of the Nuclear Research Center at Karlsruhe, GmbH, offers a range of possible dates for the resumption of storing in Asse: "1985 optimistic, 1987 realistic, 1989 realistic to pessimistic." For the spokesman of the Nuclear Research Center, Dr Klaus Koerting, an "outrage," because: "Instead of burying this trash several hundred meters under the earth, as tested, we will be stacking it in the front yard for several years."

In this regard, the storage of radioactive waste in salt, even at the end of the 1960's, was still regarded as the greatest discovery since Columbus. Egon Albrecht of the Federal Radiation and Environmental Research Corporation, mbH (GSF), Munich, which oversees the Asse under government contract, explained: "The Lower Saxony salt domes are situated in earthquake-free Northern Europe. For at least 100 million years they have existed in their present form as deposited from the ground water." Thus, radiating waste could presumably cool down for generations undisturbed by geological changes. To gather early experience for the Gorleben disposal center, the National Research Ministry thus permitted low- and medium-level residues to be stored in Asse on a test basis--a total of 124,497 drums of low-level and 1,293 concrete containers of medium-level waste since 1967. When, however, it became clear to residents in the Asse neighborhood in the course of the Borleben discussion that the containers could not be removed from Asse, making the experimental storage practically a permanent storage, resistance mounted. Hannover's Social Minister Hermann Schnipkoweit (CDU), a former salt miner, saw in such intentional quaranteening of his former work place nothing less than "betrayal of the people." Since the Bundestag in its effort to perfect the atom law had compellingly prescribed a planning process for instituting permanent radioactive-waste repositories in September 1976, Minister President Albrecht found a convenient pretext for not extending the experimental authorization for Asse which was due to expire at the end of 1978. GSF and Bonn protested, albeit in vain, on the legal point that Asse is an experimental and not a permanent repository and, thus, not subject to the compulsory planning process. Albrecht remained adamant.

To make some progress, nonetheless, GSF advanced the idea of "retrievable intermediate storage" in Asse at the end of April last year. This way out provides that low-level wastes be stored in Asse like canned goods in a supermarket until the planning process is perfected. Those in power in Bonn immediately snatched up this idea in August 1979. Of course, the "retrievable intermediate storage" would be much more expensive, would utilize only one-third of the space in the salt caverns because of stacking on pallets and would expose the workers to dangerous radiation to a greater extent than before. Commented Dr Franz Perzl of GSF: "The whole affair is foolishness, but if it is required, we'll do it."

Before the Federal and Land governments dared to hope that they could avoid expensive storage expansion with this intermediate solution, the Hannover government demonstrated anew its tactical skill already tested in playing Gorleben poker. "Radiation man" Albrecht made it known through the responsible mining office in Goslar that the idea of a retrievable intermediate storage would only be entertained if Bonn were to give up further research work at Asse. The Federal government would then, in the short haul, get the irritating atomic waste out of its throat, but experiments toward later Gorleben authorization would have to be stopped.

Albrecht's trick found favorable reception, even in Bonn. An official in the Ministry of Interior responsible for waste removal confirmed: "In the view of the disposal ministry, that would be a great intermediate solution." Chancellor Schmidt, however, avoided being lured out on this weak limb. His ministerial nuclear troops, the nuclear cabinet, resisted the temptation of a short-term solution to the agonizing disposal problem. Consequently, Lower Saxony's Minister of Economics Birgit Breuel (CDU) requested her Laender colleagues to "get involved in making a realistic assessment of the situation of expansion of their Land's collection depots." Following the challenge "radiation man, lead the way," Albrecht no longer saw fit to dump his atomic trash on his neighbors in Geesthacht, not far from Hamburg, and elected to convert 20 ammunition bunkers in Steyerberg, Lower Saxony, into a new collection station for his state. The bill for the conversion, amounting to "several hundred thousand marks" (Hannover Social Ministry) will be paid by Bonn.

To the taxpayer, it may be all the same in the end whether the state or national treasury has to lay out the money for the expensive waste storage--they have to pay the bill in any case. For the continuous output from the radiation institutes and industry have in the meantime produced a threatening shortage of space at the state collection stations. As a result, the Nuclear Research Center at Karlsruhe, which shipped 10,000 tons of waste per year to the Asse salt tomb, has already had to build a "buffer storage" at Boehm for DM 5.5 million in order to get by until the end of 1982.

Planned is an additional "high-rise storage" at Koerting for 80,000 drums. Since expensive storage buildings--their concrete walls have to withstand aircraft crashes and earthquakes--are required for reprocessing the medium-level waste from the research facilities, Professor Boehm presented to Lower-Saxon Albrecht the preliminary overall cost: "If, by the end of the 1980's, we must provide intermediate storage in Karlsruhe--may God and the politicians spare us that--it will cost DM 50 million."

To conserve space the GSF, meeting in Bavaria, plans to compress waste to one-fifth of its volume in a new type installation costing DM 17.5 million. North Rhine-Westphalia's responsible nuclear research installation, Juelich, GmbH, is building a new building for 6,000 drums. In Berlin the Hahn-Meitner Institute for Nuclear Research, GmbH, has according to estimates of Prof Juergen Hacke "still enough storage capacity for two to three more years," but additional construction is already planned.

Centered in the four coastal Laender, the Society for Nuclear Energy Application in Ship Building and Ocean Transportation, mbH, Geesthacht, sees "storage problems" coming their way. Finally, Government Director Hans-Joachim Koerner of Hessen's Measurement and Test Center, a unit of the Industrial Control Administration, announced a doubling of the storage volume in Kassel at a cost of DM 10 million.

The picture is the same for the nuclear power plants. An atomic reactor with an output of 1,000 MW produces 300 tons of low-level waste per year. The Rhine-Westphalian Electric Company has made a proposal to the Hessian social ministry for the construction of an additional storage building for the atomic waste from its two Biblis blocks.

Worn down from the hassle over Asse, GSF's Perzl fears the wrath of the citizenry. Case in point: A "Munich-North citizens' committee" has already formed in the Bavarian metropolis to oppose the above-ground storage on GSF property using the argument: "If the removal and storage of radioactive waste is not assured, then the only possible alternative is to limit radioactive materials to a minimum." Perzl's admonition to the politicans: "Simply keep the yellow drums out of the election battle."

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ITALY

PUGLIA TO BECOME SITE FOR NUCLEAR PLANT

Milan CORRIERE DELLA SERA in Italian 21 Feb 80 p 9

[Article by Gianfranco Ballardin: "Puglia Was the First To Say 'Yes' to the Nuclear Plants Program"]

[Text] A 2,000-megawatt plant (2.5 times that of Caorso) will probably be constructed north of Foggia. However, Piedmont, Friuli-Venezia Giulia, and Molise will confirm their objection to new installations.

Rome--Puglia agrees to have a 2,000-megawatt nuclear plant on its territory (a plant that will be 2.5 times more powerful than that of Caorso). This was announced in an interview with CORRIERE by the president of the Puglia region, lawyer Nicola Quarta (DC, pro-Andreotta). Quarta will confirm this officially next Thursday to Budget Minister Andreatta, who has convened a meeting of the "interregional committee for economic planning" for that date. This meeting was anticipated for today, precisely to discuss the old matter of the location of the nuclear power plants.

The Puglia decision that was advanced by President Quarta again sets in motion the Italian nuclear program, that has been at a standstill for years and that was further paralyzed as a result of the emotion and the polemics brought about by the incident in Pennsylvania (a U.S. nuclear power plant that averted a disaster by a hair's breadth. In the wake of a Puglia two other regions, Lombardy and Tuscany, might in turn agree to have an ENEL [National Electric Power Agency] nuclear power plant.

In the past 15 years only one nuclear power plant was constructed in Italy (the Caorso one, in Emilia) and only recently was work on a second power plant begun (in Montalto di Castro, in upper Lazio, 2,000 megawatts). But only yesterday the mayor of Montalto issued a decree suspending work (which ENEL has not yet received). This was motivated by an "absolute lack of guarantees for the health and safety of the people." But, up to now, work has not yet been interrupted. After interminable discussions, all of the other regions indicated by the CNEN [National Nuclear Energy

Commission] and by the ENEL (Lombardy, Piedmont, and Molise) have so far refused to have a power plant. At present the most recent ENEL programs provide for the construction of 2,000 megawatt nuclear plants in Lombardy, Piedmont, Friuli-Venezia Giulia, in Puglia and in Molise

The hour of decision is approaching. From a quick survey that we made of regional leaders, it turns out that only Puglia currently agrees to have an electro-nuclear power plant and a big coal power plant (to be located in Taranto). Lawyer Quarta explained that "we have not yet chosen a definite site for the nuclear power plant, but we are considering an area (indicated also on the CNEN 'map of sites') located in the vicinity of Lake Lesina and Lake Varano, north of Foggia. But, we have other alternative sites along the Adriatic coast, in case of necessity."

How does it happen that Puglia is the only region that agrees to a power plant?

"It is obvious," replied Quarta, "that we are the most serious. We are aware of the great dangers of an energy hole. To say 'no' to a nuclear project is a very simple matter, but also more demagogic. Risks are present in things everywhere."

Next Thursday, in the meeting that will be presided over by Andreatta, three regions (Friuli-Venezia Giulia, Piedmont, and Molise) will repeat the "no" that they already gave in their respective committees. Lombardy has not yet assumed a definite position, but up to now all the municipalities that were selected by the CNEN and by the ENEL (like Viadana and San Benedetto Po, in Mantovano) have refused.

To get out of the impasse caused by this string of no's (broken now by Puglia), Professor Felice Ippolito, one of the most courageous champions of the "nuclear option," has again launched one of his old ideas: that of constructing a nuclear power plant on the island of Pianosa, located a few miles from the island of Elba. The CNEN seized the opportunity and gave its O.K., and inserted Pianosa on the "map of sites" considered as potential locations for a nuclear power plant.

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